MASTER OF SCIENCE
IN
ENGINEERING SCIENCE

RADIO CHANNEL MODELING FOR MOBILE AD HOC WIRELESS NETWORKS

Sng Sin Hie-Civilian, Singapore Ministry of Defense
B.Eng., University of Sheffield-United Kingdom, 1999
Master of Science in Engineering Science-June 2004
Advisors: Murali Tummala, Department of Electrical and Computer Engineering
Roberto Cristi, Department of Electrical and Computer Engineering

The radio channel places fundamental limitations on the performance of mobile ad hoc wireless networks. In the mobile radio environment, fading due to multipath delay spread impairs received signals. This thesis develops a radio channel model and examines the effect of various parameters on channel behavior that is representative of environments where mobile ad hoc wireless networks operate. The various physical phenomena considered are outdoor environments, fading and multipath propagation, type of terrains, and mobility (Doppler shift). A channel model based on a Tapped Delay Line (TDL) structure is developed and implemented in the MATLAB programming language, and the performance of the time-varying channel is studied by plotting the signal constellations. Simulation results indicate that the number of taps required in the TDL is 8 or less and the carrier frequency does not influence the performance significantly. The Jakes Doppler spectrum should be used in urban environments with high mobility; the Gaussian Doppler spectrum is the choice for low mobility urban environments and for hilly terrain under both low and high mobility.

KEYWORDS: Wireless Network, Channel Model, Tapped Delay Line, Jakes Doppler Spectrum, Gaussian Doppler Spectrum